# Using video to improve mathematics' teachers' abilities to attend to classroom features: A replication study

**Using Video to Improve Preservice Mathematics Teachers' Abilities to Attend to Classroom Features: A Replication Study**[1]

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The rapid proliferation of inexpensive and fast video technologies, as well as the widening availability of video-based case studies, has made possible a variety of new and different activities in preservice teacher education. The incorporation of video technology in preservice teacher education affords a number of pedagogical advantages. For example, although teachers completing field-observation experiences typically do so alone or with one or two other classmates, limiting the opportunity for whole-class discussions of these experiences, the use of video may enable an entire class to witness the same full-length lesson and engage in a full discussion. Videos provide the additional benefit of enabling preservice teachers to witness a wider range of teachers, students, settings, pedagogies, and content than a typical field experience might. Preservice teachers may also benefit from videotaping their own field-placement classrooms and lessons, enabling them to notice things they may have missed when their attention was focused elsewhere. In recent years, teacher educators have been quick to incorporate video into their program curricula, taking advantage of its many possible uses.

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In this chapter, we report on a replication study related to one particular and potentially promising use of video technology in preservice teacher education—the effect of viewing classroom videos on teachers' abilities to notice salient features of classroom instruction. We begin with the premise that although preservice teachers spend a substantial amount of time observing other teachers' practices, what they learn as a result of these observations is unclear (Brophy, 2004). Being a good observer of another's practice is a learned skill (e.g., Berliner et al., 1988), and one reason preservice teachers' observations of practice may not be fruitful is that these teachers may not have developed the ability to understand the complexity of the classroom and the full range of events that can be observed. Only *after* developing such an appreciation of the complexity of the classroom can preservice teachers develop the subsequent and critically important skill of noticing important features of classroom instruction. In this study, we focus on ways that the medium of video can be helpful in improving preservice teachers' abilities to attend to the full range of events in classrooms, which we view as a precursor skill to noticing important features of classrooms.

We begin with an overview of the use of video in preservice teacher education in general and then discuss existing research on preservice teachers' abilities to notice salient features of classroom instruction.

### *Use of Video in Preservice Teacher Education*

By many accounts, a useful approach for preservice teachers is to make, use, and discuss video of teaching episodes, students working, or both. A growing body of research shows the positive effect of using video to help students in introductory education courses to connect learning theory with classroom practice (Bliss & Reynolds, 2004). Viewing and discussing short, edited segments of videos has proved to stimulate conversation around the issues of teaching and learning. Viewing video was also found to have the potential to focus preservice teachers' attention on aspects of teaching and learning. Stockero (2008), for example, pointed out the benefits on teacher growth of a video-case curriculum in which preservice teachers reflected on video excerpts around a particular mathematical topic.

### *Preservice Teachers' Abilities to Notice*

Sherin and van Es (2005) found that both in-service and preservice teachers demonstrated change in what they noticed and ways they talked about what they noticed as a result of reflecting on videos of their own teaching practices. Whereas in-service teachers' observations and conversations shifted from what the teacher in the video was doing to what the students were saying, preservice teachers had a change in focus from reporting chronological sequences in a lesson to focusing on particular moments during the lesson. Overall, the results of work by Sherin and colleagues (e.g., Sherin & Han, 2004) indicated that the video viewing of lessons has the potential to affect what preservice and in-service teachers observe in classroom practice.

Earlier work by Berliner and colleagues (Berliner et al., 1988; Carter, Cushing, Sabers, Stein, & Berliner, 1988) indicated that teachers' abilities to notice are related to teachers' classroom experiences: More experienced teachers are better observers of videos of classroom lessons than novices. Inexperienced teachers have difficulty focusing on students' (rather than teachers') actions, tend to view a lesson merely as a chronological but disconnected sequence of events, and are not particularly observant about issues of content.

These findings about preservice teachers' inattention to features of classrooms are significant when one considers the role of observation in teacher-education programs. Observing other teachers' practices occupies a substantial component of preservice teachers' time in many teacher-education programs, with most preservice teachers in the United States spending at least one semester observing a mentor teacher. Teacher educators expect that preservice teachers will learn from these observations, an expectation that may not be met if preservice teachers fail to notice what teacher educators hope they will notice when observing a lesson (either live or videotaped). In response to this concern, Sherin and colleagues have argued that given preservice teachers' difficulties in noticing salient features of classroom instruction, improving the ability to notice should be an explicit focus of initial teacher-preparation courses. They argued that to this end, teacher-preparation courses should provide "opportunities and structures within which teachers can develop their ability to notice" (Sherin & van Es, 2005, p. 489).

Our goal in the present study was to verify the findings of a recent study by the first author and his colleague (Star & Strickland, 2008), in which they had explored the types of classroom features and events that preservice mathematics teachers noticed before and after a semester-long methods course focused on improving observation skills. The course included both specific activities designed to improve teachers' abilities to notice and the content of a typical mathematics methods course that accompanied students' initial field observations of teaching. In the present study, we sought to confirm and extend prior findings from Star and Strickland (2008), focusing on to what beginning teachers do and do not attend when viewing a classroom lesson and whether preservice teachers' abilities to notice salient features of classroom instruction improved after the completion of a methods course that included activities designed to improve observation skills.

### *On Noticing*

In their previous work, van Es and Sherin (2002) defined *noticing* as having the following three components:

> (a) identifying what is important or noteworthy about a classroom situation; (b) making connections between the specifics of classroom interactions and the broader principles of teaching and learning they represent; and (c) using what one knows about the context to reason about classroom events. (p. 573)

Although all three of these components of noticing are important, we suggest that, particularly for preservice teachers, the first component of noticing is the most foundational. For this reason, our definition of *noticing* is limited to part (a) of the van Es and Sherin definition. We find intuitive that preservice teachers can only make sense of classroom features they can identify. If preservice teachers are unable even to identify that classroom events have occurred (part [a] of the van Es and Sherin definition), it seems natural that they will be unable either to make connections between these events and broad principles of teaching and learning (Part [b]) or to reason about these events (Part [c]). The research discussed above indicates that preservice teachers do not notice salient classroom features in a live or videotaped lesson, perhaps in part because they do not know to what to attend among the many events that occur during a classroom lesson. In the present study, we were interested in what preservice teachers did and did not attend to while viewing a classroom lesson, with the idea that their abilities to notice in the broad sense (as in van Es and Sherin's conception, *to connect and interpret events*) depend critically on what they notice in the narrow sense (*to attend to*).

Furthermore, we think it is critical for preservice teachers to activate a focus on noticing - to begin to attend to the complexity of the classroom and the full range of events that may require a teacher's attention. To be clear, some classroom events are certainly more important than others, and that it is critical that preservice teachers be able to attend to and interpret these important events. However, we believe that teachers do not have the ability to notice important events (or even to distinguish important from trivial lesson features) until *after* they have developed the ability to notice (even trivial) classroom features. We view noticing therefore as a skill that preservice teachers must learn to activate very early in their training, and only after this skill is active can teachers attempt the more sophisticated and nuanced task of determining which events are most worthy of being noticed. In line with this belief, a primary aim of the methods course described here and in our prior work was to activate or 'turn on' teachers' noticing skills; determining which events were more or less important was only a secondary and peripheral goal of the course.

### *Star and Strickland Study*

The Star and Strickland (2008) study involved two phases of data collection: (a) a preassessment in which preservice teachers viewed a video of a class session and were assessed on their abilities to notice features of the instruction they had seen in the video and (b) a postassessment of preservice teachers' abilities to notice instructional features in a (different) classroom video. The preservice teachers who served as participants were enrolled in a semester-long secondary-mathematics-methods course (taught by Star) at a large, public Midwestern university in the United States. The course under investigation was the first methods course for preservice secondary-mathematics teachers, a 15-week, one-semester course comprised of seminars, field observation, and work in a peer-teaching laboratory. Participants were either mathematics majors (*n* = 26, 11 male, 15 female) or were working toward a postbaccalaureate certification in secondary mathematics (*n* = 2, both male). Participants viewed two videos from the U.S. Public Release TIMSS video series: A 50-minute eighth-grade lesson on exponents was the target of the preassessment, and a 45-minute eighth-grade lesson on angles, arc lengths, secants, and tangents was the target of the postassessment. The research team generated a list of assessment questions for each video; participants were asked to recall classroom features and events in five observation categories: classroom environment, classroom management, mathematical content, tasks, and communication (see Table 1). The preassessment was administered to preservice teachers in September, in one of the first classes of their methods course; the postassessment was administered in December, in one of the last classes of the semester.

The results of the preassessment showed that preservice teachers generally do not enter teaching methods courses with well-developed observation skills. The postassessment indicated that the course led to significant increases in preservice teachers' observation skills. The largest improvements were seen in teachers' abilities to notice features of the classroom environment and tasks. More modest gains were seen in teachers' abilities to notice the mathematical content of a lesson, classroom management, and teacher and student communication during a lesson.

In their study, Star and Strickland (2008) utilized a preassessment/postassessment design, asked participants to watch full-length videos of a class period, and focused on an *attending* definition of noticing, as opposed to the more typical conception of Sherin et al., in which attending is only a subcomponent of noticing (van Es & Sherin, 2002). With the goal of confirming and extending the results from the Star and Strickland study, we replicated it, duplicating the method used by Star and Strickland in nearly every way, with only minor adjustment to the assessments for clarification, as described below.

## Method

The present study, with its preassessment/postassessment design, included two phases of data collection: (a) a preassessment measuring preservice teachers' abilities to notice instructional features in a full-length video of a class period and (b) a postassessment of preservice teachers' abilities to notice instructional features in a (different) classroom video.

*Participants*

The participants in this study, mathematics majors in college ($N$ = 30), were preservice teachers enrolled in a semester-long secondary-mathematics-methods course (taught by Star) at a large, public Midwestern university in the United States. Although many of the participants had prior formal and informal teaching experience, none had previously participated in a formal student-teaching experience. Prior to enrolling in the course, all participants had completed introductory education courses focused on learning theories, diversity in education, and literacy across subjects in the curriculum.

*Measures*

The assessments were written instruments designed to explore what teachers noticed (attended to) after watching full-length videos of a class period in an eighth-grade-mathematics classroom. Participants viewed the two TIMSS videos used by Star and Strickland (2008).

The measures used by Star and Strickland (2008) were modified for this study in the following two ways (see Star & Strickland, 2008, for details on design of the original assessment): First, in the present study nine questions were included in each assessment for each observation category, whereas in Star and Strickland, the number of questions for each observation category ranged from 6 to 15. Second, although many questions were the same in the two studies, some were refined and clarified in the present study.

*Procedure*

The preassessment was administered to preservice teachers in September, during the third class period of the methods course. Prior to watching the video, participants were instructed that they would watch a video of one entire class period of an eighth-grade-mathematics class and that after the video they would be asked questions about what they had noticed about the class. At the conclusion of the video, the preassessment was handed out. Participants were given 60 minutes to complete the assessment; everyone finished in the allotted time. The postassessment was administered in December, on one of the last classes of the semester, using the same procedure.

Members of the research team who had participated in the construction of the assessment and the scoring rubric graded all assessments.

*Description of Course*

The course under investigation was the first methods course for preservice secondary-mathematics teachers. During each week in a 15-week semester, preservice teachers had 4 hours of seminar, 4 hours of field observation, and 2 hours in a peer-teaching laboratory. The two primary aims for the course, as in the course studied by Star and Strickland (2008), were to improve preservice teachers' abilities to notice and interpret salient events in classroom lessons and to begin to develop preservice teachers' abilities to plan and implement lessons. In the first weeks of the course (after administration of the preassessment), after watching and discussing several classroom videos, the observation framework described in Table 1 was introduced to the preservice teachers. This framework served to organize the remainder of the course, in that subsequent class activities involved in-depth readings, small- and large-group discussions, role playing, and lesson-video viewing around each observation category.

Our focus in the present study was on to what teachers attended prior to the course and as a result of the course. We collected no qualitative or process data that would have enabled us to describe how the course changed preservice teachers' abilities to notice, such as which course features were most effective, how these course features were implemented, or the nature of preservice teachers' discussions that may have been instrumental in prompting preservice teachers to become more attentive to lesson features. In future studies, we plan to address the question of how course activities can affect preservice teachers' abilities to notice. The data sources for the present study are limited to the preassesments and postassessments.

## Results

We first discuss results from the present study similar to those found by Star and Strickland (2008), followed by results that diverge from that prior work.

### *Convergent Findings*

In many areas, the results from the present study converge with the findings of Star and Strickland (2008). We elaborate below on similar findings in the *Classroom Environment* and *Communication* observation categories.

*Classroom Environment.* As found by Star and Strickland (2008), preservice teachers in the present study showed particularly large gains in their abilities to notice features of the classroom environment as a result of the course. On the preassessment, preservice teachers possessed relatively weak skills in observing the classroom environment, correctly answering only 46% of questions in this category (see Table 2). Low-scoring questions (answered correctly by fewer than 15% of the students) asked students to identify items they had noticed in the classroom, such as a chalkboard and an overhead projector; estimate how many students were in the classroom; and recall whether the teacher was left-handed. For example, on one question, although all participants correctly recalled that the classroom in the video contained a whiteboard, few noticed a computer and an overhead projector, and none noticed all three. On another low-scoring question, which asked how many students were in the room, most participants incorrectly responded that there were 26–35 students (19 responses) or 15–25 students (6 responses) in the room, when, in fact, there were more than 35 students in the room.

On the postassessment, by contrast, preservice teachers displayed remarkable attentiveness to features of the classroom environment. Students scored 78% correct on the classroom-environment questions at postassessment, with six high-performing questions (>70%) and more than 50% correct on all questions. When asked to notice items on the walls in the classroom, 100% of the participants responded correctly. A second high-performing question, asking the number of students in the classroom (similar to the low-scoring question about class size on the preassessment), was answered correctly by all but one participant at postassessment.

Indeed, students showed substantial improvement at postassessment on questions corresponding to each of their low-performing areas at preassessment. For example, whereas on the preassessment none of the participants noticed both a computer and a projector in the classroom, on the postassessment 73% noticed both items. Students also became more observant of characteristics of the teacher; on the preassessment only 7% of participants correctly noticed that the teacher was left-handed, but on the postassessment 63% noticed that the teacher was right-handed, with many commenting additionally that her right-handedness contributed to students' difficulty in seeing what she was writing.

*Communication.* In addition to convergent results in the *Classroom Environment* category, we found similar results in *Communication*. As found by Star and Strickland (2008), on questions about classroom communication, preservice teachers experienced improvements.

Preservice teachers began the study with relatively weak observation skills in the area of classroom communication. *Communication* was the category with the lowest scores on the preassessment, with participants answering only 41% of communication questions correctly.

At the preassessment, participants scored particularly low on questions relating to how the teacher gave directions, how the teacher asked students questions and responded to their comments, and what questions the students asked the teacher. For example, when asked the first thing the teacher talked about after the bell rang to begin the class, only 27% of participants correctly noted that she told the students where to sit. When asked about the teacher's style of posing questions to her class, only 27% correctly noted that she opened her questions to everyone in the class instead of calling on specific students. Scores were particularly low on a question about how the teacher responded to a specific comment from a student; only 30% remembered that she had told the student that he was correct. The preassessment question with the lowest score asked participants to recall a question that a student had asked the teacher during a whole-class discussion; none of the participants remembered that the student had asked, "Do we have to write it in words?"

At postassessment, participants' scores in observing classroom communication improved somewhat, to an average of 49%. Participants performed well on a question asking them to record at least three questions they remembered the teacher asking; 70% of respondents were able to do this on the postassessment. In addition, on a second high-scoring question, 77% of respondents correctly noted that the teacher reminded the students at the end of class to study for an upcoming quiz.

However, participants' performance on the postassessment in the *Communication* category continued to be somewhat mediocre, with three questions on which only 37% of participants responded correctly. For example, only 37% of participants correctly remembered the first thing the teacher talked about after the bell rang. A second low-scoring question asked participants to recall the teacher‘s frustration at her students’ inability to find a “pattern” in the problems from the lesson. Only 37% of participants remembered that the teacher had commented, “You guys are scaring me.” The third relatively low-scoring question asked how the teacher usually referred to the class as a whole; only 37% noted that she usually referred to the class as “you guys.”

Thus, whereas overall teachers in both studies improved their observation skills in the area of classroom communication, the performance of teachers in the current study in this category is mixed. Participants had some increased success in noticing what kinds of questions the teacher asked and what types of reminders she gave students, but they still missed many nuances in communication, such as the teacher’s word choice, how she addressed students, and how she responded to students’ answers.

*Divergent Findings*

In several areas our present results diverged from findings of Star and Strickland (2008). In particular, we discuss below our findings that preservice teachers in the present study did *not* show improvement in the observation categories of *Tasks* and *Mathematical Content* and *did* show improvement in *Classroom Management*.

*Tasks*. The *Tasks* category refers to the instructional and assessment activities of the teacher and the students in class. Our preassessment focused on the teacher’s actions that served the lesson objectives, such as the structure of the group work, presentation of the material, and assignment of homework.

In the current study, preservice teachers scored an average of 57% on the preassessment in this category. Specifically, the higher performing questions dealt mostly with the sequence of the activities that occurred during the lesson as well as the structure of the presented material. For example, one high-performing question asked participants to arrange a series of classroom activities in the order in which they had occurred in the video; 70% of participants were able to recall the correct sequence. Another moderately high-performing question in this category asked participants to recall how many different rules for multiplying exponents the lesson covered; 63% noticed that the lesson focused on three such rules.

In contrast, the preassessment included several questions that indicated participants' difficulties in attending to features of the lesson tasks. For example, one question asked how the teacher started the lecture/discussion; only 37% of students were able to correctly recall that the teacher did a quick review of base and exponent topics from the previous grade. As another example, only 33% of students noticed that the teacher used stacks of unifix cubes and a graph as visual aids to highlight exponential growth.

Students' scores in the *Tasks* category at postassessment ($M$ = 55%) showed no improvement from the preassessment ($M$ = 57%). (These results differed from the original study, in which participants’ scores increased from a mean of 65% at the preassessment to 80% at the postassessment.) One high-performing question on the postassessment related to the type of visual aid the teacher used during the lesson; 93% of participants recalled the teacher's use of an overhead projector. However, participants continued to have difficulty noticing details about lesson tasks; for example, only 17% of students answered on the postassessment that students’ homework from the previous class consisted of problems from the textbook. As another example, only 43% of students noticed that the teacher started the lesson with the Problem of the Day on an overhead.

*Mathematical Content.* Mathematical content included questions about the representation of the mathematics, the examples used, and the problems posed. As was the case in Star and Strickland (2008), in the present study preservice mathematics teachers began the study with relatively weak skills in observing the mathematical content of a lesson. For example, when asked, on the preassessment, whether a student had asked the teacher if *aaa/bbb* = 1 because the *a*s cancel and the *b*s cancel, *all* participants in the current study said that this event had indeed happened, but no such event occurred in the classroom video. A similar pattern was seen in the results of the Star and Strickland (2008) study, in which at preassessment the preservice teachers had difficulties noticing subtleties in the ways that the teacher helped students think about mathematical content. In sum, results from both studies showed that at preassessment preservice teachers' abilities to notice features of the mathematical content of a lesson were somewhat weak.

Although Star and Strickland (2008) found that preservice teachers did show improvement in their abilities to notice issues of mathematical content, similar gains were *not* found in the present study. Perhaps the explanation for these divergent findings with respect to mathematical content is that revisions to the assessment used in the present study increased the difficulty level of questions in this observation category. Several questions in Star and Strickland (2008) that were considered part of the *Mathematical Content* observation category were closer to *Tasks*, *Communication,* or both, and these are the questions on which students in the original study did well at postassessment. For example, 82% of participants in the original study correctly identified as false a statement related to whether the teacher asked "why" after students offered suggestions or solutions—a question related to content but more properly classified in the *Communication* category. Similarly, a question about how the teacher referred to the lesson content of the day (using the textbook chapter and section *number* or using the chapter and section *name*) does relate to content but is more properly categorized in the *Tasks* category; 82% of participants in the original study answered this question correctly on the postassessment. When the prior assessment was modified, these questions were removed or modified, resulting in a more pure and difficult assessment of students' noticing of mathematical content.

*Classroom Management*. The preservice teachers in the current study differed from their counterparts in the original study in their level of attentiveness to classroom-management events. The mean score for the preassessment in the current study was only 68%, compared to 80% in the Star and Strickland (2008) study. Note, however, that this 68% performance was the highest among all observation categories in the current study and thus is consistent with prior research findings indicating that preservice teachers are quite concerned about classroom management (Sabers, Cushing, & Berliner, 1991). Higher performing questions about classroom management included observations of teacher actions in maintaining control of the classroom environment. For example, 93% of students noticed that the teacher went from table to table observing and answering student questions. Similarly, 77% of students noticed that the teacher took attendance in the beginning of class and visited every table group during the class. In addition, preservice teachers in the current study were also attentive to classroom procedures, such as the arrangement of desks, the distribution of lesson materials, and the taking of attendance.

At the postassessment, participants showed modest improvement in their observations of classroom procedures as well as teachers’ interactions with students; mean scores in this category increased from 68% to 74%. (These results diverge from those obtained by Star and

Strickland (2008), who found no improvement from pre- to post-assessment in the category of *Classroom Management*.) For example, when preservice teachers were asked about the teacher's calling on students, 93% of participants correctly noted in the postassessment that the teacher mostly called on students when their hands were raised, compared to only 57% correct on a similar question at preassessment. More generally, preservice teachers were highly observant of procedures the teacher followed, including that she prepared overheads, that she did not distribute papers during the class, and that she did not take the attendance. The divergent results from Star and Strickland (2008) may be attributed to a ceiling effect in the original study, in which the preservice teachers started with high awareness of classroom-management events, with little room to improve.

*Noticing of Important Classroom Features*

Recall that in our assessment we intentionally included both mundane and important features of classroom lessons to enable us to explore the full range of what preservice teachers did and did not notice. To what extent did preservice teachers' abilities to notice *important* classroom events improve as a result of the methods course?

Before reporting the results of this analysis, recall that our assessment, this study, and the methods course more generally were not designed to explore this question. In particular, individual assessment items were not created and labeled *a priori* as assessing important or less important classroom features. Furthermore, the methods course itself was centrally concerned with improving teachers' ability to notice all kinds of events in the classroom, rather than helping preservice teachers identify a subset of noticed events that were more or less important. However, we attempted to determine *post hoc* which questions appeared to target important aspects of the pre- and post-assessment lessons, to enable us to determine whether teachers improved in their ability to notice important events.

Two graduate students, both of whom had prior experience as middle or secondary mathematics teachers, viewed the pre- and post-assessment videos, studied the pre- and post-assessments, and then independently rated whether each question assessed an important facet of the lesson. No prior discussion was held to discuss the construct of *important;* rather, each rater was left to make this determination on her own. The two raters then met to compare their *importance* ratings. Questions that both raters independently scored as assessing important features of each lesson were classified as *important questions.* All other questions were classified as *other*.

The rating exercise yielded the following results. On the preassessment, 26 questions were deemed important by both raters. Important questions were identified in all observation categories; however, the fewest important questions came from the *Classroom Environment* category. Important questions concerned pedagogical choices made by the teacher, mathematical content addressed in the lesson, and teacher-student communication. On the postassessment, 26 questions were deemed important by both raters. Similar to those on the preassessment, important questions were selected from all observation categories, but with the fewest from *Classroom Environment*, and important questions concerned pedagogical choices made by the teacher, mathematical content addressed in the lesson, and teacher-initiated communication, both during the lesson and while addressing individual students.

Using these importance ratings, we computed preservice teachers' mean scores for important and other questions, for both the pre- and post-assessment; *t*-tests were used to explore whether differences in teachers' mean scores were statistically significant. On the preassessment, teachers' mean score on important questions was 53% correct, whereas the mean score on other questions was 50% correct. This difference was not significant, $p = .33$, indicating that preservice teachers began the study being no less (or more) observant of important lesson features than of other features.

On the postassessment, preservice teachers showed improvement on both important and other questions, with the mean score on important questions increasing to 59% correct and the mean score on other questions increasing to 65% correct. Regarding teachers' gains from pre- to post-assessment (and consistent with the overall results described above), preservice teachers showed significant improvement in their performance on both important ($p < .05$) and other ($p < .001$) questions. However, at postassessment, participants' performance was significantly lower on important questions as compared to other questions, $p < .05$. Thus, although teachers became better observers of classroom features generally, by the end of the course, preservice teachers' observation skills continued to be stronger on classroom features that were less important.

## Discussion

A key premise underlying both our current and previous studies is that teachers may need explicit training in how to observe mathematics lessons. In a typical teacher-preparation program, preservice teachers spend a significant amount of time observing the teaching of others, with the expectation that preservice teachers will learn by watching other teachers' lessons. Such learning is predicated, however, on the assumption that novice teachers are capable of attending to (and subsequently interpreting) salient features of mathematics lessons. Prior research indicates that novice teachers are not particularly astute observers of mathematics lessons nor are preservice teachers capable of sorting the important from the less important aspects of classroom practice. Both the present study and our earlier work confirm that preservice secondary-mathematics teachers at the beginning of a teacher-preparation program are not particularly keen observers of classroom practice but that observation skills can be improved in a one-semester methods course.

Our primary goal for the present study was to replicate the results of Star and Strickland (2008). Our results indicate that this goal was met in that teachers in both courses did show overall improvements in their abilities to observe classroom interactions. Looking more closely, we found that, as shown by Star and Strickland, preservice teachers were not particularly good observers of classroom features at the beginning of the methods course, with weak performances in all observation categories. At the conclusion of the course, teachers showed substantial improvement in some areas. As was the case in our prior study, noticing of features of the classroom environment showed the most dramatic improvement. Similarly, postassessment performance on questions relating to classroom management was quite high. In the category of communication, teachers also experienced improvement, though at the end of the course their mean score was only 49%,

Some results of the present study differed from our expectations based on past work. Preservice teachers failed to show improvement in their abilities to notice features of tasks (on which they did improve in the Star and Strickland [2008] study); similarly, performance in the *Mathematical Content* observation category was stagnant. Although some of these differences may result from modifications of the assessments for the present study, we wondered whether lower average preassessment scores played a role. Compared with teachers in the Star and Strickland (2008) study, preservice teachers in the present study began with a lower level of attentiveness to the category of *Tasks* at preassessment. In the current study, preservice teachers scored an average of 57% on the preassessment in this category compared to the mean of 65% at preassessment in the original study. Similarly, teachers in the current study scored an average of 41% on preassessments in the *Communication* category, as opposed to 60% in the original study. Perhaps improvements in *Mathematical Content* require a stronger grounding in *Tasks* and *Communication*. Or perhaps the ability to closely observe *Tasks, Mathematical Content*, and *Communication* are related. Thus, what we have observed here is initial growth in *Communication* so that, as in Star and Strickland (2008), average scores in the categories of *Mathematical Content* and *Communication* are about the same and the average score on *Tasks* is slightly higher.

Note that improving preservice teachers' abilities to attend to classroom features does not eliminate the subsequent need to help teachers develop abilities to notice and interpret *important* classroom features. The assessments used here were designed to assess teachers' noticing of a wide range of lesson characteristics—including both important and relatively trivial features. Although our methods course was instrumental in helping teachers attend to a greater variety of events in a lesson, we had more limited success at improving teachers' noticing of important events. (Given that the goal of the course was to improve noticing generally and not noticing of important events, this finding is perhaps not surprising.) As found by Star and Strickland (2008), teachers made great strides in their abilities to attend to features of the classroom environment, but they continued to have difficulties noticing aspects of the mathematics content of the lesson, a lesson dimension that is arguably more critical than whether the classroom contained a chalkboard or an overhead projector.

Why might teachers show improvement in their abilities to notice classroom features but still struggle to notice *important* classroom events? Two answers are indicated by the present results. First, important events may be inherently harder to notice. The most attention-grabbing features of a lesson (to a novice) may not be those that (in the eyes of an experienced teacher) are most important. Although noticing the color the walls are painted or whether the teacher was male or female may be relatively easy, attending to the exact words, facial expression, and body language used by a student who asks a question or the specific example that a teacher uses to clarify a student misconception may be more challenging. Important classroom events may be inherently subtle, nuanced, and difficult to notice—more so than less important lesson features. Second, preservice teachers may not have developed the ability to distinguish between important and unimportant lesson features. In the absence of an observational compass that points toward important events, teachers' attention will be attracted by whatever is most visually salient, obvious, or personally compelling—independent of its importance in the lesson. Both explanations are plausible.

In either case, teacher educators need to think carefully about what it is entailed in an event’s being important in a lesson. Determining what is and is not important in a lesson is a nontrivial task (even for experts). In particular, although in the present analysis important events were identified from all observation categories, recall that the fewest important events (as scored by two experienced mathematics teachers) related to *Classroom Environment*. One might reasonably conclude that certain observation categories are more densely populated with important events than are other categories; for example, one could propose that *Mathematical Content* is *always* more important to observe carefully than *Classroom Environment*. However, determining what is and is not important is likely to be complex, nuanced, and fundamentally influenced by the perspective of the observer. One could imagine a scenario in which features of the classroom environment were critically important in a lesson, yet in other instances, such details might be trivial. Regardless, a significant result from both the present and earlier studies is the importance of methods courses designed to explicitly focus on improving observation skills and helping teachers to be more aware of important events.

Finally, note this study did not provide evidence in support of (or against) a central premise of our work - that teachers do not have the ability to notice important events (or even to distinguish important from trivial lesson features) until *after* they have developed the ability to notice (even trivial) classroom features. We found that preservice teachers began the methods course with relatively poor observational skills, and after a course focused on improving their ability to notice a full range of classroom events, preservice teachers were better observers of both mundane and important events. If the ultimate goal is for teachers to be able to notice important classroom events, neither this study nor Star and Strickland (2008) tested whether it is better to focus first on improving teachers' awareness of the full range of (trivial and important) events (as was done here), or to focus explicitly on only important events from the outset. Future research may consider exploring this interesting issue.

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*Table 1*

Five Observation Categories for Preassessments and Postassessments

| *Category* | *Description* | *Sample assessment questions* |
|---|---|---|
| Classroom environment | The physical setting of the classroom, including desk arrangements, materials, and equipment available and utilized; demographics of students and teacher, including class size and grade level | How many students were in the room? (Fewer than 15; between 15 and 25; between 26 and 35; more than 35)<br><br>On what kind of equipment did the teacher draw the graph of $2^x$? |
| Classroom management | The ways the teacher manages classroom events, including disruptive events, pace changes, and procedures for calling on students or handling homework | Is the way the desks were arranged the common, daily arrangement?<br><br>Did the teacher make it to every table group during the class? |
| Tasks | The activities students do in the class period (e.g., warm-ups, worksheets, taking notes, presentations, passing out papers, upcoming quizzes, and homework) | Which best describes the structure of the activities? (Students observe book's examples, then determine operation to get that result, then develop theorem; class proves/discusses a theorem, then applies theorems to get an answer to a problem; not sure)<br><br>True or false: None of the groups on |

| | | |
|---|---|---|
| | | camera get to the second proof. |
| Mathematical Content | The mathematics of the lesson, including its representation of the mathematics (graphs, equations, tables, models), the examples used, and the problems posed | In one scene, a student asks if $ab^3$ is the same as $a^3b^3$. How did the teacher handle this misconception?<br><br>True or false: The teacher forgot to mention that the bases must be the same to multiply two exponents together. |
| Communication | Communication between students or between teacher and students, including questions posed and answers or suggestions offered | True or false: When the teacher puts a problem on the screen, she gives students time to solve it before discussing the answer/solution.<br><br>Record at least three questions you remember the teacher asking. |

*Table 2*

Results for Preassessments and Postassessments (Percentages Correct)

| | *Present Study* | | *Star and Strickland (2008)* | |
|---|---|---|---|---|
| *Category* | *Pre* | *Post* | *Pre* | *Post* |
| Classroom environment | 46 | 78 | 44 | 86 |
| Classroom management | 68 | 74 | 80 | 80 |
| Tasks | 57 | 55 | 65 | 80 |
| Mathematical content | 50 | 49 | 54 | 70 |
| Communication | 41 | 49 | 60 | 70 |